MATERIALS

CERAMICS

Examining a ceramic-to-metal brazing of specific cutting tools

French company DIAMONDE specialises in the design and manufacture of customised cutting tools for industry.

THE PROBLEM TO SOLVE

Due to a thermal expansion mismatch between the different materials involved, residual stresses are generated in specific tools during the ceramic-to-metal brazing method. DIAMONDE wanted to determine the internal through-thickness stresses in the ceramic in order to improve the manufacturing process.

A STEP TOWARDS THE SOLUTION

Neutron stress-scanning is a non-destructive technique that allows the same sample to be measured following each step of the process. Measurement of the stress and strain is possible up to several centimetres below the surface of a metal or ceramic.

Collaborators at Technische Universität München (TUM) and the German Engineering Materials Science Centre (GEMS) in Germany carried out stress profile measurements on DIAMONDE's samples using the Stress-Spec instrument (Fig.1) at the Heinz Maier-Leibnitz Zentrum in Garching, Germany.

A probe volume of 5 mm^3 was defined by neutron beams and four points were measured in the 3 principal directions up to 3.5 mm across the ceramic thickness. Line scans were performed across the entire sample area at a depth of 3 mm.

THE RESULT

On this specific example, the stress profiles for the 3 principal directions indicate that the overall stress distribution is quite smooth in terms of intensity and direction. The result, in combination with other measurements, assesses the quality of the brazing process.

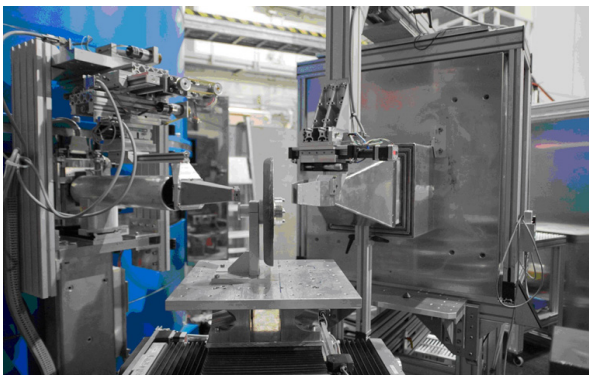

Fig. 1 The Stress-Spec instrument at FRM II in Garching, Germany. Slit-system for residual stress analysis. Source: MLZ

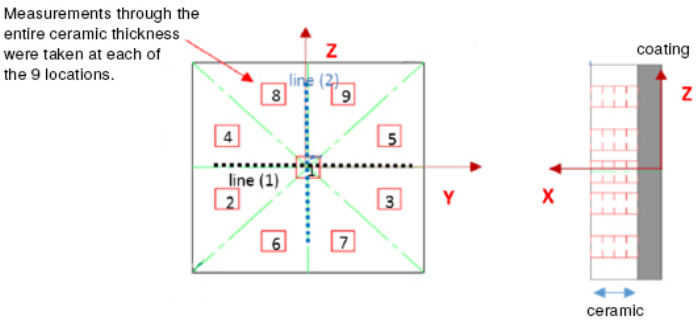

Fig. 2 Localisation of measurement points on the coated ceramic component. Stress measurements through the ceramic thickness revealed quite a smooth distribution of stress in terms of intensity and direction.

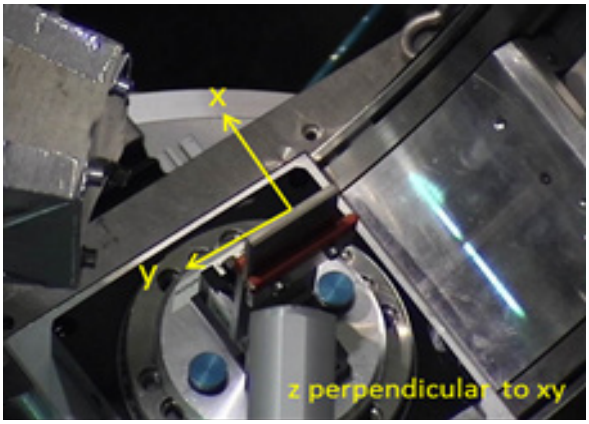

Fig.3 Picture showing sample positioning on STRESS-SPEC and the scanning directions.

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